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SEQUENCE LISTING

IAP20 Rec'd 10 FEB 2006

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 The initiation codon (ATG position 1546-1548) and the termination
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5 <223> Sequence of 9949 bp Sau3AI genomic DNA fragment of *S. bulbocastan*
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26

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29

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 Phe Ser Ala Leu Ser Lys Asp Ile Ala Asp Val Leu Val Phe Leu Glu
 20 25 30
 aat gag gaa aat caa aaa gct ctt gac aaa gat caa gtt gaa aag ata 144
 Asn Glu Glu Asn Gln Lys Ala Leu Asp Lys Asp Gln Val Glu Lys Ile
 35 40 45
 50 aaa ttg aaa atg gca ttt att tgt aca tat gtt cag ctt tct tgt tcc 192
 Lys Leu Lys Met Ala Phe Ile Cys Thr Tyr Val Gln Leu Ser Cys Ser
 50 55 60
 55 gat ttt gag cag ttt gaa gat ata atg act aga aaa aga caa gag gtt 240
 Asp Phe Glu Gln Phe Glu Asp Ile Met Thr Arg Lys Arg Gln Glu Val
 65 70 75 80
 60 gag aat ctg ctt caa cca ctt ttg gat gat gat gtc ttt act agc ctc 288
 Glu Asn Leu Leu Gln Pro Leu Leu Asp Asp Asp Val Phe Thr Ser Leu
 85 90 95
 acc agt aat atg gat gac tgt atc agc ttg tat cat cgt tct tat aaa 336
 Thr Ser Asn Met Asp Asp Cys Ile Ser Leu Tyr His Arg Ser Tyr Lys
 100 105 110
 65 tca gat gcc atc atg atg gat gag caa ttg gac ttc ctc ctc ttg aat 384
 Ser Asp Ala Ile Met Met Asp Glu Gln Leu Asp Phe Leu Leu Leu Asn

30

	115	120	125	
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15	cat ggg ttg ata gtg aat ggt tgc att aag cat gag atg gtt gag aat His Gly Leu Ile Val Asn Gly Cys Ile Lys His Glu Met Val Glu Asn 165 170 175	528		
20	gtc ttr cct ctg ttt caa ctc atg gct gac aga gta gga cac ttc ctt Val Xaa Pro Leu Phe Gln Leu Met Ala Asp Arg Val Gly His Phe Leu 180 185 190	576		
25	tgg gat gat cag act gat gaa gac tct cga ctc tcc gag cta gat gag Trp Asp Asp Gln Thr Asp Glu Asp Ser Arg Leu Ser Glu Leu Asp Glu 195 200 205	624		
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65	cgt gtc gga gta ctt acc agg gag gta tca act ctt gta cgt gac ttg Arg Val Gly Val Leu Thr Arg Glu Val Ser Thr Leu Val Arg Asp Leu 325 330 335	1008		
70	gaa gag gaa cca agg aat aaa gag ggt aat aac caa aca aat tgt gca Glu Glu Glu Pro Arg Asn Lys Glu Gly Asn Asn Gln Thr Asn Cys Ala 340 345 350	1056		
75	acc cta gac ttg ctg gaa aat att gaa ctc ctc aag aaa gat ctc aaa Thr Leu Asp Leu Leu Glu Asn Ile Glu Leu Leu Lys Lys Asp Leu Lys 355 360 365	1104		
80	cat gtt tat ctg aaa gcc ctg gat tca tct caa tgt tgc ttc ccc atg His Val Tyr Leu Lys Ala Leu Asp Ser Ser Gln Cys Cys Phe Pro Met 370 375 380	1152		
85	agt gat gga cca ctc ttc atg cat ctt cta cac ata cac tta aat gat Ser Asp Gly Pro Leu Phe Met His Leu Leu His Ile His Leu Asn Asp 385 390 395	1200		

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10	gag ctg gtg aag caa gac ctg aaa ttc ata aga tca ttc ttt gtg gat Glu Leu Val Lys Gln Asp Leu Lys Phe Ile Arg Ser Phe Phe Val Asp	420	425	430	1296
15	gct gag caa gga ttg tat aaa gat ctc tgg gca cgt gtt cta gat gtg Ala Glu Gln Gly Leu Tyr Lys Asp Leu Trp Ala Arg Val Leu Asp Val	435	440	445	1344
20	gct tat gag gca aaa gat gtc ata gat tca att att gtt cga gat aat Ala Tyr Glu Ala Lys Asp Val Ile Asp Ser Ile Ile Val Arg Asp Asn	450	455	460	1392
25	ggg ctc tta cat ctt att ttc tca ctt ccc att acc ata aag aag atc Gly Leu Leu His Leu Ile Phe Ser Leu Pro Ile Thr Ile Lys Lys Ile	465	470	475	1440
30	aaa ctt atc aaa gaa gag atc tct gct tta gat gag aac att ccc aag Lys Leu Ile Lys Glu Glu Ile Ser Ala Leu Asp Glu Asn Ile Pro Lys	485	490	495	1488
35	gac aga ggt cta atc gtt gtg aac tct ccc aag aaa cca gtt gag aga Asp Arg Gly Leu Ile Val Val Asn Ser Pro Lys Lys Pro Val Glu Arg	500	505	510	1536
40	aag tca ttg aca act gat aaa ata act gta ggt ttt gag gag gaa aca Lys Ser Leu Thr Thr Asp Lys Ile Thr Val Gly Phe Glu Glu Glu Thr	515	520	525	1584
45	aac ttg ata ctt aga aag ctc acc agt gga tcg gca gat cta gat gtc Asn Leu Ile Leu Arg Lys Leu Thr Ser Gly Ser Ala Asp Leu Asp Val	530	535	540	1632
50	att tcg atc act ggt atg ccg ggt tca ggt aaa act act ttg gca tac Ile Ser Ile Thr Gly Met Pro Gly Ser Gly Lys Thr Thr Leu Ala Tyr	545	550	555	1680
55	aaa gta tac aat gat aag tca gtt tct agc cgt ttc gac ctt cgt gca Lys Val Tyr Asn Asp Lys Ser Val Ser Ser Arg Phe Asp Leu Arg Ala	565	570	575	1728
60	tgg tgc acg gtc gac caa gga tgt gat gag aag aag ttg ttg aat aca Trp Cys Thr Val Asp Gln Gly Cys Asp Glu Lys Lys Leu Leu Asn Thr	580	585	590	1776
65	att ttc agt caa gtt agt gac tca gat tca aaa ttg agt gag aat att Ile Phe Ser Gln Val Ser Asp Ser Asp Ser Lys Leu Ser Glu Asn Ile	595	600	605	1824
70	gat gtt gct gat aaa tta cgg aaa caa ctg ttt gga aag agg tat ctt Asp Val Ala Asp Lys Leu Arg Lys Gln Leu Phe Gly Lys Arg Tyr Leu	610	615	620	1872
75	att gtc tta gat gac gtg tgg gat act act aca tgg gat gag tta aca Ile Val Leu Asp Asp Val Trp Asp Thr Thr Thr Trp Asp Glu Leu Thr	625	630	635	1920
80	aga cct ttt cct gaa tct aag aaa gga agt agg att att ttg aca act Arg Pro Phe Pro Glu Ser Lys Lys Gly Ser Arg Ile Ile Leu Thr Thr	645	650	655	1968
85	cgg gaa aag gaa gtg gct ttg cat gga aag ctg aac act gat cct ctt Arg Glu Lys Glu Val Ala Leu His Gly Lys Leu Asn Thr Asp Pro Leu				2016

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10	agg gca ttt ggg aat gag agt tgc cct gat gaa cta tta gat gtc ggt Arg Ala Phe Gly Asn Glu Ser Cys Pro Asp Glu Leu Leu Asp Val Gly 690 695 700	2112		
15	aaa gaa ata gcc gaa aat tgt aaa ggg ctt cct ttg gtg gct gat ctg Lys Glu Ile Ala Glu Asn Cys Lys Gly Leu Pro Leu Val Ala Asp Leu 705 710 715 720	2160		
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25	gaa gtt caa agt agt ttg agt tct ttt att ttg aac agt gaa gtg gaa Glu Val Gln Ser Ser Leu Ser Ser Phe Ile Leu Asn Ser Glu Val Glu 740 745 750	2256		
30	gtg atg aaa gtt ata gaa tta agt tat gac cat tta cca cat cac ctc Val Met Lys Val Ile Glu Leu Ser Tyr Asp His Leu Pro His His Leu 755 760 765	2304		
35	aag cca tgc ttg ctg tat ttt gca agt ttt ccg aag gac act tca ttg Lys Pro Cys Leu Leu Tyr Phe Ala Ser Phe Pro Lys Asp Thr Ser Leu 770 775 780	2352		
40	aca atc tat gag ttg aat gtt tat ttc ggt gct gaa gga ttt gtg gga Thr Ile Tyr Glu Leu Asn Val Tyr Phe Gly Ala Glu Gly Phe Val Gly 785 790 795 800	2400		
45	aag acg gag atg aac agt atg gaa gaa gtg gtg aag att tat atg gat Lys Thr Glu Met Asn Ser Met Glu Glu Val Val Lys Ile Tyr Met Asp 805 810 815	2448		
50	gat tta att tac agt agc ttg gta att tgt ttc aat gag ata ggt tat Asp Leu Ile Tyr Ser Ser Leu Val Ile Cys Phe Asn Glu Ile Gly Tyr 820 825 830	2496		
55	gca ctg aat ttc caa att cat gat ctt gtg cat gac ttt tgt ttg ata Ala Leu Asn Phe Gln Ile His Asp Leu Val His Asp Phe Cys Leu Ile 835 840 845	2544		
60	aaa gca aga aag gaa aat ttg ttt gat cag ata aga tca agt gct cca Lys Ala Arg Lys Glu Asn Leu Phe Asp Gln Ile Arg Ser Ser Ala Pro 850 855 860	2592		
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70	cac ttt ggg ctt aat ttt gtc atg ttc gat tca aat aag aaa agg cat His Phe Gly Leu Asn Phe Val Met Phe Asp Ser Asn Lys Lys Arg His 885 890 895	2688		
75	tct ggt aaa cac ctc tat tct ttg agg ata att gga gac cag ctg gat Ser Gly Lys His Leu Tyr Ser Leu Arg Ile Ile Gly Asp Gln Leu Asp 900 905 910	2736		
80	gac agt gtt tct gat gca ttt cac cta aga cac ttg agg ctt ctt aga Asp Ser Val Ser Asp Ala Phe His Leu Arg His Leu Arg Leu Leu Arg 915 920 925	2784		
85	gtg ttg gac ctg cat acg tct ttt atc atg gtg aaa gat tct ttg ctg Val Leu Asp Leu His Thr Ser Phe Ile Met Val Lys Asp Ser Leu Leu	2832		

	930	935	940	
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30	aca aag tta gag aac ttg aga ata tta acg gaa ctg ttg att tcc Thr Lys Leu Glu Asn Leu Arg Ile Leu Thr Glu Leu Leu Ile Ser 1025 1030 1035	3114		
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75	gaa gac acc ttt gag aat ctc aaa ttt ttg aac ttc aat caa gtt Glu Asp Thr Phe Glu Asn Leu Lys Phe Leu Asn Phe Asn Gln Val 1160 1165 1170	3519		
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	Pro Ser Phe Gly Asp Ile Tyr	Ser Leu Lys Ser Ile	Lys Ile Val	
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10	aag agt cct caa ctt gaa gat	tct gct ctc aaa att	aag gaa tac	3699
	Lys Ser Pro Gln Leu Glu Asp	Ser Ala Leu Lys Ile	Lys Glu Tyr	
	1220	1225	1230	
	gct gaa gat atg agg gga ggg	gac gag ctt cag atc	ctt ggc caa	3744
	Ala Glu Asp Met Arg Gly Gly	Asp Glu Leu Gln Ile	Leu Gly Gln	
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	20 25 30			
50	Asn Glu Glu Asn Gln Lys Ala Leu Asp Lys Asp Gln Val Glu Lys Ile			
	35 40 45			
	Lys Leu Lys Met Ala Phe Ile Cys Thr Tyr Val Gln Leu Ser Cys Ser			
	50 55 60			
55	Asp Phe Glu Gln Phe Glu Asp Ile Met Thr Arg Lys Arg Gln Glu Val			
	65 70 75 80			
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	85 90 95			
65	Thr Ser Asn Met Asp Asp Cys Ile Ser Leu Tyr His Arg Ser Tyr Lys			
	100 105 110			
	Ser Asp Ala Ile Met Met Asp Glu Gln Leu Asp Phe Leu Leu Leu Asn			

35

	115		120		125
5	Leu Tyr His 130	Leu Ser Lys 135	His His Ala 135	Glu Lys Ile 140	Phe Pro Gly Val
10	Thr Gln Tyr 145	Glu Val Leu 150	Gln Asn Ile 155	Cys Gly Asn 155	Ile Arg Asp Phe 160
15	His Gly Leu 165	Ile Val Asn 165	Gly Cys Ile 170	Lys His Glu 170	Met Val Glu Asn 175
20	Val Xaa Pro 180	Leu Phe Gln 185	Leu Met Ala 185	Asp Arg Val 190	Gly His Phe Leu 190
25	Trp Asp Asp 195	Gln Thr Asp 200	Glu Asp Ser 205	Arg Leu Ser 205	Glu Leu Asp Glu 205
30	Asp Glu Gln 210	Asn Asp Arg 215	Asp Ser Arg 220	Leu Phe Lys 220	Leu Ala His Leu 220
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45	Gln Leu Leu 260	Glu Thr Ser 265	Pro Asp Ile 265	Leu Arg Glu 270	Tyr Leu Ile Pro 270
50	Leu Gln Glu 275	His Met Val 280	Thr Val Ile 280	Thr Pro Ser 285	Thr Ser Gly Ala 285
55	Arg Asn Ile 290	His Val Met 295	Met Glu Phe 295	Leu Leu Leu 300	Ile Leu Ser Asp 300
60	Met Pro Lys 305	Asp Phe Ile 310	His His Asp 315	Lys Leu Phe 315	Asp Leu Leu Asp 320
65	Arg Val Gly 325	Val Leu Thr 325	Arg Glu Val 330	Ser Thr Leu 330	Val Arg Asp Leu 335
70	Glu Glu Glu 340	Pro Arg Asn 345	Lys Glu Gly 345	Asn Asn Gln 350	Thr Asn Cys Ala 350
75	Thr Leu Asp 355	Leu Leu Glu 360	Asn Ile Glu 360	Leu Leu Lys 365	Lys Asp Leu Lys 365
80	His Val Tyr 370	Leu Lys Ala 375	Leu Asp Ser 380	Ser Ser Gln 380	Cys Cys Phe Pro Met 380
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 435 440 445
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 450 455 460
 25 Gly Leu Leu His Leu Ile Phe Ser Leu Pro Ile Thr Ile Lys Lys Ile
 465 470 475 480
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 565 570 575
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 65 Ile Phe Ser Gln Val Ser Asp Ser Asp Ser Lys Leu Ser Glu Asn Ile
 595 600 605
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 625 630 635 640
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 645 650 655
 85 Arg Glu Lys Glu Val Ala Leu His Gly Lys Leu Asn Thr Asp Pro Leu

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15	Lys Glu Ile Ala Glu Asn Cys Lys Gly Leu Pro Leu Val Ala Asp Leu 705 710 715 720		
20	Ile Ala Gly Val Ile Ala Gly Arg Glu Lys Lys Arg Ser Val Trp Leu 725 730 735		
25	Glu Val Gln Ser Ser Leu Ser Ser Phe Ile Leu Asn Ser Glu Val Glu 740 745 750		
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45	Lys Thr Glu Met Asn Ser Met Glu Glu Val Val Lys Ile Tyr Met Asp 805 810 815		
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	His Phe Gly Leu Asn Phe Val Met Phe Asp Ser Asn Lys Lys Arg His 885 890 895		
	Ser Gly Lys His Leu Tyr Ser Leu Arg Ile Ile Gly Asp Gln Leu Asp 900 905 910		
	Asp Ser Val Ser Asp Ala Phe His Leu Arg His Leu Arg Leu Leu Arg 915 920 925		
	Val Leu Asp Leu His Thr Ser Phe Ile Met Val Lys Asp Ser Leu Leu		

	930	935	940
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	Ser Leu Phe Val Ser Thr Asn Arg Ser Ile Leu Val Leu Leu Pro Arg 980 985 990		
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	Ser Leu Ser Thr Ile Ala Arg Leu Pro Asn Leu Glu Glu Leu Ser 1130 1135 1140		
55	Leu Tyr His Thr Ile Ile His Gly Glu Glu Trp Asn Met Gly Glu 1145 1150 1155		
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	1190	1195	1200	
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50	aat gag gaa aat caa aaa gct ctt gac aaa gat caa gtt gaa aag cta Asn Glu Glu Asn Gln Lys Ala Leu Asp Lys Asp Gln Val Glu Lys Leu 35 40 45			144
55	aaa ttg aaa atg gca ttt att tgt aca tat gtt cag ctt tct tat tcc Lys Leu Lys Met Ala Phe Ile Cys Thr Tyr Val Gln Leu Ser Tyr Ser 50 55 60			192
60	gat ttt gag cag ttt gaa gat ata atg act aga aat aga caa gag gtt Asp Phe Glu Gln Phe Glu Asp Ile Met Thr Arg Asn Arg Gln Glu Val 65 70 75 80			240
65	gag aat ctg ctt caa tca ctt ttg gat gat gat gtc ctt act agc ctc Glu Asn Leu Leu Gln Ser Leu Leu Asp Asp Asp Val Leu Thr Ser Leu 85 90 95			288
70	acc agt aat atg gat gac tgt atc agc ttg tat cat cgt tct tat aaa Thr Ser Asn Met Asp Asp Cys Ile Ser Leu Tyr His Arg Ser Tyr Lys 100 105 110			336

40

	tca gat gcc atc atg atg gat gag caa ttg gac ttc ctc ctc ttg aat	384
	Ser Asp Ala Ile Met Met Asp Glu Gln Leu Asp Phe Leu Leu Asn	
	115 120 125	
5	ctg tat cat cta tcc aag cat cac gct gaa aag ata ttt cct gga gtg	432
	Leu Tyr His Leu Ser Lys His His Ala Glu Lys Ile Phe Pro Gly Val	
	130 135 140	
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	Thr Gln Tyr Glu Val Leu Gln Asn Val Cys Gly Asn Ile Arg Asp Phe	
	145 150 155 160	
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	His Gly Leu Ile Leu Asn Gly Cys Ile Lys His Glu Met Val Glu Asn	
	165 170 175	
20	gtc tta cct ctg ttt caa ctc atg gct gaa aga gta gga cac ttc ctt	576
	Val Leu Pro Leu Phe Gln Leu Met Ala Glu Arg Val Gly His Phe Leu	
	180 185 190	
25	tgg gag gat cag act gat gaa gac tct cgg ctc tcc gag cta gat gag	624
	Trp Glu Asp Gln Thr Asp Glu Asp Ser Arg Leu Ser Glu Leu Asp Glu	
	195 200 205	
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	Asp Glu His Asn Asp Arg Asp Ser Arg Leu Phe Gln Leu Thr His Leu	
	210 215 220	
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	Leu Leu Lys Ile Val Pro Thr Glu Leu Glu Val Met His Ile Cys Tyr	
	225 230 235 240	
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	Thr Asn Leu Lys Ala Ser Thr Ser Ala Glu Val Gly Arg Phe Ile Lys	
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	Leu Gln Glu His Met Leu Thr Val Ile Pro Pro Ser Thr Leu Gly Ala	
	275 280 285	
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	Arg Asn Ile His Val Met Met Glu Phe Leu Leu Ile Leu Ser Asp	
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	Met Pro Lys Asp Phe Ile His His Asp Lys Leu Phe Asp Leu Leu Ala	
	305 310 315 320	
65	cat gtt gga aca ctt acc agg gag gta tgc act ctt gta cgt gac ttg	1008
	His Val Gly Thr Leu Thr Arg Glu Val Ser Thr Leu Val Arg Asp Leu	
	325 330 335	
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	Glu Glu Lys Leu Arg Asn Lys Glu Gly Asn Asn Gln Thr Asn Cys Ala	
	340 345 350	
75	acc cta gac ttg ctg gaa aat att gaa ctc ctc aag aaa gat ctc aaa	1104
	Thr Leu Asp Leu Leu Glu Asn Ile Glu Leu Leu Lys Lys Asp Leu Lys	
	355 360 365	
80	cat gtt tat ctg aaa gcc cca aat tca tct caa tgt tgc ttc ccc atg	1152
	His Val Tyr Leu Lys Ala Pro Asn Ser Ser Gln Cys Cys Phe Pro Met	
	370 375 380	

41

	agt gat gga cca ctc ttc atg cat ctt cta cac atg cac tta aat gat	1200
	Ser Asp Gly Pro Leu Phe Met His Leu Leu His Met His Leu Asn Asp	
	385 390 395 400	
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	Leu Leu Asp Ser Asn Ala Tyr Ser Ile Ser Leu Ile Lys Glu Glu Ile	
	405 410 415	
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	Glu Leu Val Ser Gln Glu Leu Glu Phe Ile Arg Ser Phe Phe Gly Asp	
	420 425 430	
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	Ala Ala Glu Gln Gly Leu Tyr Lys Asp Ile Trp Ala Arg Val Leu Asp	
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	Val Ala Tyr Glu Ala Lys Asp Val Ile Asp Ser Ile Ile Val Arg Asp	
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	Asn Gly Leu Leu His Leu Ile Phe Ser Leu Pro Ile Thr Ile Lys Lys	
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	Ile Lys Leu Ile Lys Glu Glu Ile Ser Ala Leu Asp Glu Asn Ile Pro	
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	Thr Asn Leu Ile Leu Arg Lys Leu Thr Ser Gly Pro Ala Asp Leu Asp	
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	Val Ile Ser Ile Thr Gly Met Pro Gly Ser Gly Lys Thr Thr Leu Ala	
	545 550 555 560	
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	Tyr Lys Val Tyr Asn Asp Lys Ser Val Ser Arg His Phe Asp Leu Arg	
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	Ala Trp Cys Thr Val Asp Gln Gly Tyr Asp Asp Lys Lys Leu Leu Asp	
	580 585 590	
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	Thr Ile Phe Ser Gln Val Ser Gly Ser Asp Ser Asn Leu Ser Glu Asn	
	595 600 605	
60	att gat gtt gct gat aaa ttg cgg aaa caa ctg ttt gga aag agg tat	1872
	Ile Asp Val Ala Asp Lys Leu Arg Lys Gln Leu Phe Gly Lys Arg Tyr	
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	Leu Ile Val Leu Asp Asp Val Trp Asp Thr Thr Thr Leu Asp Glu Leu	
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65	aca aga cct ttt cct gaa gct aag aaa gga agt agg att att ttg aca	1968
	Thr Arg Pro Phe Pro Glu Ala Lys Lys Gly Ser Arg Ile Ile Leu Thr	
	645 650 655	

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	Lys Arg Thr Phe Gly Asn Glu Ser Cys Pro Asp Glu Leu Leu Asp Val	
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	Gly Lys Glu Ile Ala Glu Asn Cys Lys Gly Leu Pro Leu Val Ala Asp	
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20	ctg att gct gga gtc att gct ggg agg gaa aag aaa agg agt gtg tgg	2208
	Leu Ile Ala Gly Val Ile Ala Gly Arg Glu Lys Lys Arg Ser Val Trp	
	725 730 735	
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	Leu Glu Val Gln Ser Ser Leu Ser Ser Phe Ile Leu Asn Ser Glu Val	
	740 745 750	
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	820 825 830	
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	Asp Ile Leu Asn Phe Gln Ile His Asp Leu Val His Asp Phe Cys Leu	
	835 840 845	
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	Ile Lys Ala Arg Lys Glu Asn Leu Phe Asp Arg Ile Arg Ser Ser Ala	
	850 855 860	
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	865 870 875 880	
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	Glu Glu His Phe Gly Leu Asn Phe Val Met Phe Asp Ser Asn Lys Lys	
	885 890 895	
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	Arg His Ser Gly Lys His Leu Tyr Ser Leu Arg Ile Asn Gly Asp Gln	
	900 905 910	
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	Leu Asp Asp Ser Val Ser Asp Ala Phe His Leu Arg His Leu Arg Leu	
	915 920 925	

43

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	1070 1075 1080	
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 1220 1225 1230

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Thr Ser Asn Met Asp Asp Cys Ile Ser Leu Tyr His Arg Ser Tyr Lys
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60 Ser Asp Ala Ile Met Met Asp Glu Gln Leu Asp Phe Leu Leu Leu Asn
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65 Leu Tyr His Leu Ser Lys His His Ala Glu Lys Ile Phe Pro Gly Val
 130 135 140

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5 His Gly Leu Ile Leu Asn Gly Cys Ile Lys His Glu Met Val Glu Asn
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10 Val Leu Pro Leu Phe Gln Leu Met Ala Glu Arg Val Gly His Phe Leu
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15 Trp Glu Asp Gln Thr Asp Glu Asp Ser Arg Leu Ser Glu Leu Asp Glu
 195 200 205

20 Asp Glu His Asn Asp Arg Asp Ser Arg Leu Phe Gln Leu Thr His Leu
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 245 250 255

30 Lys Leu Leu Glu Thr Ser Pro Asp Ile Leu Arg Glu Tyr Ile Ile Gln
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Lys Arg Thr Phe Gly Asn Glu Ser Cys Pro Asp Glu Leu Leu Asp Val
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25

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30

Leu Thr Ile Tyr Leu Phe Thr Val Tyr Leu Gly Ala Glu Gly Phe Val
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Pro Ser Asp Leu Leu Pro Arg Gln Ile Thr Ile Asp Tyr Asp Glu Glu
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Glu Glu His Phe Gly Leu Asn Phe Val Met Phe Asp Ser Asn Lys Lys
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Arg His Ser Gly Lys His Leu Tyr Ser Leu Arg Ile Asn Gly Asp Gln
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55

<220>

<221> primer

60 <222> (1)..(25)

<223>

65

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35 <220>
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40 <222> (1)..(21)
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45 <400> 90
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20

21

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	Met Ala Glu Ala Phe Ile Gln Val Leu Leu Asp Asn Leu Thr Ser Phe		
	1 5 10 15		
55	ctc aaa ggg gaa ctt gta ttg ctt ttc ggt ttt caa gat gag ttc caa		96
	Leu Lys Gly Glu Leu Val Leu Leu Phe Gly Phe Gln Asp Glu Phe Gln		
	20 25 30		
60	agg ctt tca agc atg ttt tct aca att caa gcc gtc ctt gaa gat gct		144
	Arg Leu Ser Ser Met Phe Ser Thr Ile Gln Ala Val Leu Glu Asp Ala		
	35 40 45		
	cag gag aag caa ctc aac aac aag cct cta gaa aat tgg ttg caa aaa		192
	Gln Glu Lys Gln Leu Asn Asn Lys Pro Leu Glu Asn Trp Leu Gln Lys		
65	50 55 60		
	ctc aat gct gct aca tat gaa gtc gat gac atc ttg gat gaa tat aaa		240
	Leu Asn Ala Ala Thr Tyr Glu Val Asp Asp Ile Leu Asp Glu Tyr Lys		

	65		70		75		80		
5	acc aag gcc aca aga ttc tcc cag tct gaa tat ggc cgt tat cat cca							288	
	Thr Lys Ala Thr Arg Phe Ser Gln Ser Glu Tyr Gly Arg Tyr His Pro		85		90		95		
10	aag gtt atc cct ttc cgt cac aag gtc ggg aaa agg atg gac caa gtg							336	
	Lys Val Ile Pro Phe Arg His Lys Val Gly Lys Arg Met Asp Gln Val	100		105			110		
15	atg aaa aaa cta aag gca att gct gag gaa aga aag aat ttt cat ttg							384	
	Met Lys Lys Leu Lys Ala Ile Ala Glu Glu Arg Lys Asn Phe His Leu	115		120			125		
20	cac gaa aaa att gta gag aga caa gct gtt aga cgg gaa aca ggt tct							432	
	His Glu Lys Ile Val Glu Arg Gln Ala Val Arg Arg Glu Thr Gly Ser	130		135			140		
25	gta tta acc gaa ccg cag gtt tat gga aga gac aaa gag aaa gat gag							480	
	Val Leu Thr Glu Pro Gln Val Tyr Gly Arg Asp Lys Glu Lys Asp Glu	145		150			155	160	
30	ata gtg aaa atc cta ata aac aat gtt agt gat gcc caa cac ctt tca							528	
	Ile Val Lys Ile Leu Ile Asn Asn Val Ser Asp Ala Gln His Leu Ser	165			170			175	
35	gtc ctc cca ata ctt ggt atg ggg gga tta gga aaa acg act ctt gcc							576	
	Val Leu Pro Ile Leu Gly Met Gly Gly Leu Gly Lys Thr Thr Leu Ala	180			185			190	
40	caa atg gtc ttc aat gac cag aga gtt act gag cat ttc cat tcc aaa							624	
	Gln Met Val Phe Asn Asp Gln Arg Val Thr Glu His Phe His Ser Lys	195			200			205	
45	ata tgg att tgt gtc tcg gaa gat ttt gat gag aag agg tta ata aag							672	
	Ile Trp Ile Cys Val Ser Glu Asp Phe Asp Glu Lys Arg Leu Ile Lys	210			215			220	
50	gca att gta gaa tct att gaa gga agg cca cta ctt ggt gag atg gac							720	
	Ala Ile Val Glu Ser Ile Glu Gly Arg Pro Leu Leu Gly Glu Met Asp	225			230			235	240
55	ttg gct cca ctt caa aag aag ctt cag gag ttg ctg aat gga aaa aga							768	
	Leu Ala Pro Leu Gln Lys Lys Leu Gln Glu Leu Leu Asn Gly Lys Arg	245				250		255	
60	tac ttg ctt gtc tta gat gat gtt tgg aat gaa gat caa cag aag tgg							816	
	Tyr Leu Leu Val Leu Asp Asp Val Trp Asn Glu Asp Gln Gln Lys Trp	260				265		270	
65	gct aat tta aga gca gtc ttg aag gtt gga gca agt ggt gct tct gtt							864	
	Ala Asn Leu Arg Ala Val Leu Lys Val Gly Ala Ser Gly Ala Ser Val	275				280		285	
70	cta acc act act cgt ctt gaa aag gtt gga tca att atg gga aca ttg							912	
	Leu Thr Thr Thr Arg Leu Glu Lys Val Gly Ser Ile Met Gly Thr Leu	290				295		300	
75	caa cca tat gaa ctg tca aat ctg tct caa gaa gat tgt tgg ttg ttg							960	
	Gln Pro Tyr Glu Leu Ser Asn Leu Ser Gln Glu Asp Cys Trp Leu Leu	305				310		315	320
80	ttc atg caa cgt gca ttt gga cac caa gaa gaa ata aat cca aac ctt								1008
	Phe Met Gln Arg Ala Phe Gly His Gln Glu Glu Ile Asn Pro Asn Leu	325					330		335
85	gtg gca atc gga aag gag att gtg aaa aaa agt ggt ggt gtg cct cta								1056
	Val Ala Ile Gly Lys Glu Ile Val Lys Lys Ser Gly Gly Val Pro Leu								

	340	345	350	
5	gca gcc aaa act ctt gga ggt att ttg tgc ttc aag aga gaa gaa aga Ala Ala Lys Thr Leu Gly Gly Ile Leu Cys Phe Lys Arg Glu Glu Arg 355 360 365	1104		
10	gca tgg gaa cat gtg aga gac agt ccg att tgg aat ttg cct caa gat Ala Trp Glu His Val Arg Asp Ser Pro Ile Trp Asn Leu Pro Gln Asp 370 375 380	1152		
15	gaa agt tct att ctg cct gcc ctg agg ctt agt tac cat caa ctt cca Glu Ser Ser Ile Leu Pro Ala Leu Arg Leu Ser Tyr His Gln Leu Pro 385 390 395 400	1200		
20	ctt gat ttg aaa caa tgc ttt gcg tat tgt gcg gtg ttc cca aag gat Leu Asp Leu Lys Gln Cys Phe Ala Tyr Cys Ala Val Phe Pro Lys Asp 405 410 415	1248		
25	gcc aaa atg gaa aaa gaa aag cta atc tct ctg tgg atg gcg cat ggt Ala Lys Met Glu Lys Glu Lys Leu Ile Ser Leu Trp Met Ala His Gly 420 425 430	1296		
30	ttt ctt tta tca aaa gga aac atg gag cta gag gat gtg ggc gat gaa Phe Leu Leu Ser Lys Gly Asn Met Glu Leu Glu Asp Val Gly Asp Glu 435 440 445	1344		
35	gta tgg aaa gaa tta tac ttg agg tct ttt ttc caa gag att gaa gtt Val Trp Lys Glu Leu Tyr Leu Arg Ser Phe Phe Gln Glu Ile Glu Val 450 455 460	1392		
40	aaa gat ggt aaa act tat ttc aag atg cat gat ctg atc cat gat ttg Lys Asp Gly Lys Thr Tyr Phe Lys Met His Asp Leu Ile His Asp Leu 465 470 475 480	1440		
45	gca aca tct ctg ttt tca gca aac aca tca agc agc aat atc cgt gaa Ala Thr Ser Leu Phe Ser Ala Asn Thr Ser Ser Ser Asn Ile Arg Glu 485 490 495	1488		
50	ata aat aaa cac agt tac aca cat atg atg tcc att ggt ttc gcc gaa Ile Asn Lys His Ser Tyr Thr His Met Met Ser Ile Gly Phe Ala Glu 500 505 510	1536		
55	gtg gtg ttt ttt tac act ctt ccc ccc ttg gaa aag ttt atc tcg tta Val Val Phe Phe Tyr Thr Leu Pro Pro Leu Glu Lys Phe Ile Ser Leu 515 520 525	1584		
60	aga gtg ctt aat cta ggt gat tcg aca ttt aat aag tta cca tct tcc Arg Val Leu Asn Leu Gly Asp Ser Thr Phe Asn Lys Leu Pro Ser Ser 530 535 540	1632		
65	att gga gat cta gta cat tta aga tac ttg aac ctg tat ggc agt ggc Ile Gly Asp Leu Val His Leu Arg Tyr Leu Asn Leu Tyr Gly Ser Gly 545 550 555 560	1680		
70	atg cgt agt ctt cca aag cag tta tgc aag ctt caa aat ctg caa act Met Arg Ser Leu Pro Lys Gln Leu Cys Lys Leu Gln Asn Leu Gln Thr 565 570 575	1728		
75	ctt gat cta caa tat tgc acc aag ctt tgt tgt ttg cca aaa gaa aca Leu Asp Leu Gln Tyr Cys Thr Lys Leu Cys Cys Leu Pro Lys Glu Thr 580 585 590	1776		
80	agt aaa ctt ggt agt ctg cga aat ctt tta ctt gat ggt agc cag tca Ser Lys Leu Gly Ser Leu Arg Asn Leu Leu Leu Asp Gly Ser Gln Ser 595 600 605	1824		
85	ttg act tgt atg cca cca agg ata gga tca ttg aca tgc ctt aag act Leu Thr Cys Met Pro Pro Arg Ile Gly Ser Leu Thr Cys Leu Lys Thr	1872		

	610	615	620	
5	cta ggt caa ttt gtt gtt gga agg aag aaa ggt tat caa ctt ggt gaa Leu Gly Gln Phe Val Val Gly Arg Lys Lys Gly Tyr Gln Leu Gly Glu 625 630 635 640			1920
10	cta gga aac cta aat ctc tat ggc tca att aaa atc tcg cat ctt gag Leu Gly Asn Leu Asn Leu Tyr Gly Ser Ile Lys Ile Ser His Leu Glu 645 650 655			1968
15	aga gtg aag aat gat aag gac gca aaa gaa gcc aat tta tct gca aaa Arg Val Lys Asn Asp Lys Asp Ala Lys Glu Ala Asn Leu Ser Ala Lys 660 665 670			2016
20	ggg aat ctg cat tct tta agc atg agt tgg aat aac ttt gga cca cat Gly Asn Leu His Ser Leu Ser Met Ser Trp Asn Asn Phe Gly Pro His 675 680 685			2064
25	ata tat gaa tca gaa gaa gtt aaa gtg ctt gaa gcc ctc aaa cca cac Ile Tyr Glu Ser Glu Glu Val Lys Val Leu Glu Ala Leu Lys Pro His 690 695 700			2112
30	tcc aat ctg act tct tta aaa atc tat ggc ttc aga gga atc cat ctc Ser Asn Leu Thr Ser Leu Lys Ile Tyr Gly Phe Arg Gly Ile His Leu 705 710 715 720			2160
35	cca gag tgg atg aat cac tca gta ttg aaa aat att gtc tct att cta Pro Glu Trp Met Asn His Ser Val Leu Lys Asn Ile Val Ser Ile Leu 725 730 735			2208
40	att agc aac ttc aga aac tgc tca tgc tta cca ccc ttt ggt gat ctg Ile Ser Asn Phe Arg Asn Cys Ser Cys Leu Pro Pro Phe Gly Asp Leu 740 745 750			2256
45	cct tgt cta gaa agt cta gag tta cac tgg ggg tct gcg gat gtg gag Pro Cys Leu Glu Ser Leu Glu Leu His Trp Gly Ser Ala Asp Val Glu 755 760 765			2304
50	tat gtt gaa gaa gtg gat att gat gtt cat tct gga ttc ccc aca aga Tyr Val Glu Glu Val Asp Ile Asp Val His Ser Gly Phe Pro Thr Arg 770 775 780			2352
55	ata agg ttt cca tcc ttg agg aaa ctt gat ata tgg gac ttt ggt agt Ile Arg Phe Pro Ser Leu Arg Lys Leu Asp Ile Trp Asp Phe Gly Ser 785 790 795 800			2400
60	ctg aaa gga ttg ctg aaa aag gaa gga gaa gag caa ttc cct gtg ctt Leu Lys Gly Leu Leu Lys Lys Glu Gly Glu Glu Gln Phe Pro Val Leu 805 810 815			2448
65	gaa gag atg ata att cac gag tgc cct ttt ctg acc ctt tct tct aat Glu Glu Met Ile Ile His Glu Cys Pro Phe Leu Thr Leu Ser Ser Asn 820 825 830			2496
70	ctt agg gct ctt act tcc ctc aga att tgc tat aat aaa gta gct act Leu Arg Ala Leu Thr Ser Leu Arg Ile Cys Tyr Asn Lys Val Ala Thr 835 840 845			2544
75	tca ttc cca gaa gag atg ttc aaa aac ctt gca aat ctc aaa tac ttg Ser Phe Pro Glu Glu Met Phe Lys Asn Leu Ala Asn Leu Lys Tyr Leu 850 855 860			2592
80	aca atc tct cgg tgc aat aat ctc aaa gag ctg cct acc agc ttg gct Thr Ile Ser Arg Cys Asn Asn Leu Lys Glu Leu Pro Thr Ser Leu Ala 865 870 875 880			2640
85	agt ctg aat gct ttg aaa agt cta aaa att caa ttg tgt tgc gca cta Ser Leu Asn Ala Leu Lys Ser Leu Lys Ile Gln Leu Cys Cys Ala Leu 885 890 895 900			2688

82

	885	890	895	
5	gag agt ctc cct gag gaa ggg ctg gaa ggt tta tct tca ctc aca gag Glu Ser Leu Pro Glu Glu Gly Leu Glu Gly Leu Ser Ser Leu Thr Glu 900 905 910	2736		
10	tta ttt gtt gaa cac tgt aac atg cta aaa tgt tta cca gag gga ttg Leu Phe Val Glu His Cys Asn Met Leu Lys Cys Leu Pro Glu Gly Leu 915 920 925	2784		
15	cag cac cta aca acc ctc aca agt tta aaa att cgg gga tgt cca caa Gln His Leu Thr Thr Leu Thr Ser Leu Lys Ile Arg Gly Cys Pro Gln 930 935 940	2832		
20	ctg atc aag cgg tgt gag aag gga ata gga gaa gac tgg cac aaa att Leu Ile Lys Arg Cys Glu Lys Gly Ile Gly Glu Asp Trp His Lys Ile 945 950 955 960	2880		
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30	<210> 94 <211> 970 <212> PRT <213> Solanum bulbocastanum			
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45	Arg Leu Ser Ser Met Phe Ser Thr Ile Gln Ala Val Leu Glu Asp Ala 35 40 45			
50	Gln Glu Lys Gln Leu Asn Asn Lys Pro Leu Glu Asn Trp Leu Gln Lys 50 55 60			
55	Leu Asn Ala Ala Thr Tyr Glu Val Asp Asp Ile Leu Asp Glu Tyr Lys 65 70 75 80			
60	Thr Lys Ala Thr Arg Phe Ser Gln Ser Glu Tyr Gly Arg Tyr His Pro 85 90 95			
65	Lys Val Ile Pro Phe Arg His Lys Val Gly Lys Arg Met Asp Gln Val 100 105 110			
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	His Glu Lys Ile Val Glu Arg Gln Ala Val Arg Arg Glu Thr Gly Ser			

	130		135		140
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	Val Leu Pro Ile Leu Gly Met Gly Gly Leu Gly Lys Thr Thr Leu Ala 180 185 190				
15	Gln Met Val Phe Asn Asp Gln Arg Val Thr Glu His Phe His Ser Lys 195 200 205				
20	Ile Trp Ile Cys Val Ser Glu Asp Phe Asp Glu Lys Arg Leu Ile Lys 210 215 220				
25	Ala Ile Val Glu Ser Ile Glu Gly Arg Pro Leu Leu Gly Glu Met Asp 225 230 235 240				
30	Leu Ala Pro Leu Gln Lys Lys Leu Gln Glu Leu Leu Asn Gly Lys Arg 245 250 255				
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40	Leu Thr Thr Thr Arg Leu Glu Lys Val Gly Ser Ile Met Gly Thr Leu 290 295 300				
45	Gln Pro Tyr Glu Leu Ser Asn Leu Ser Gln Glu Asp Cys Trp Leu Leu 305 310 315 320				
50	Phe Met Gln Arg Ala Phe Gly His Gln Glu Glu Ile Asn Pro Asn Leu 325 330 335				
	Val Ala Ile Gly Lys Glu Ile Val Lys Lys Ser Gly Gly Val Pro Leu 340 345 350				
55	Ala Ala Lys Thr Leu Gly Gly Ile Leu Cys Phe Lys Arg Glu Glu Arg 355 360 365				
60	Ala Trp Glu His Val Arg Asp Ser Pro Ile Trp Asn Leu Pro Gln Asp 370 375 380				
65	Glu Ser Ser Ile Leu Pro Ala Leu Arg Leu Ser Tyr His Gln Leu Pro 385 390 395 400				
	Leu Asp Leu Lys Gln Cys Phe Ala Tyr Cys Ala Val Phe Pro Lys Asp				

84

	405	410	415
5	Ala Lys Met Glu Lys Glu Lys Leu Ile Ser Leu Trp Met Ala His Gly 420 425 430		
10	Phe Leu Leu Ser Lys Gly Asn Met Glu Leu Glu Asp Val Gly Asp Glu 435 440 445		
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25	Ala Thr Ser Leu Phe Ser Ala Asn Thr Ser Ser Ser Asn Ile Arg Glu 485 490 495		
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65	Leu Thr Cys Met Pro Pro Arg Ile Gly Ser Leu Thr Cys Leu Lys Thr 610 615 620		
70	Leu Gly Gln Phe Val Val Gly Arg Lys Lys Gly Tyr Gln Leu Gly Glu 625 630 635 640		
75	Leu Gly Asn Leu Asn Leu Tyr Gly Ser Ile Lys Ile Ser His Leu Glu 645 650 655		
80	Arg Val Lys Asn Asp Lys Asp Ala Lys Glu Ala Asn Leu Ser Ala Lys 660 665 670		
85	Gly Asn Leu His Ser Leu Ser Met Ser Trp Asn Asn Phe Gly Pro His		

	675	680	685
5	Ile Tyr Glu Ser Glu Glu Val Lys Val Leu Glu Ala Leu Lys Pro His 690 695 700		
10	Ser Asn Leu Thr Ser Leu Lys Ile Tyr Gly Phe Arg Gly Ile His Leu 705 710 715 720		
15	Pro Glu Trp Met Asn His Ser Val Leu Lys Asn Ile Val Ser Ile Leu 725 730 735		
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	Glu Ser Leu Pro Glu Glu Gly Leu Glu Gly Leu Ser Ser Leu Thr Glu 900 905 910		
	Leu Phe Val Glu His Cys Asn Met Leu Lys Cys Leu Pro Glu Gly Leu 915 920 925		
	Gln His Leu Thr Thr Leu Thr Ser Leu Lys Ile Arg Gly Cys Pro Gln 930 935 940		
	Leu Ile Lys Arg Cys Glu Lys Gly Ile Gly Glu Asp Trp His Lys Ile		

945

950

955

960

5 Ser His Ile Pro Asn Val Asn Ile Tyr Ile
965 970